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10/763,059	01/22/2004	Yoshihiko Kuroki	S1459.70077US00	3714

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EXAMINER	
CHEN, CHIA WEI A	

ART UNIT	PAPER NUMBER
2622	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.**	**Applicant(s)**	
	10/763,059	KUROKI ET AL.	
	Examiner	**Art Unit**	
	CHIA-WEI A. CHEN	2622	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 April 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-37* is/are pending in the application.

4a) Of the above claim(s) *11-20 and 22-36* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,21 and 37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 5 April 2010 have been fully considered but they are not persuasive.

Applicant argues with respect to independent claims 1, 10, 21, and 37 that the combination of Anderson with MacAulay and Holzbach does not teach the claimed invention, and that the expectation of success is absent in the asserted combination. Specifically, Applicant argues that “if the multiple angle micromirror of Anderson was used in the microscope of MacAulay, light from source 4 of MacAulay would not be incident on sample 30, except at one angle of the micromirrors which corresponds to the ‘on’ position taught by MacAulay.” (Applicant’s Remarks, filed 5 April 2010, pg. 13.)

However, Examiner respectfully disagrees. MacAulay teaches that the “modulator controller selects a plurality of desired angles of illumination of the sample such that the plurality of angles of illumination of the sample such that the plurality of images of the sample at a corresponding plurality of different depths are obtained without moving the sample, a condenser lens, or an objective lens;" see col. 4, lines 47-51. That is, the incoming angles of light to be incident on the sample are selected by a computer-implemented program (col. 4, lines 31-32) from a single light source 4 via a spatial light modulator to impinge at different portions of the sample in order to capture a plurality of different images of the sample, so that the sample can be recreated three-dimensionally. Since MacAulay does not expressly teach a structure of a spatial light modulator capable of changing the angles of light (although MacAulay teaches the method, MacAulay does not disclose in detail of the spatial light modulator to perform this function), Anderson is used to teach this specific structure of a spatial light modulator. Therefore, Applicant's assertion that a multiple angle micromirror of Anderson can project light to be incident on the sample at only one angle is incorrect. Thus, the rejections of the pending claims are sustained.

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1-5, 8, 10, 21, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over MacAulay (US 6,483,641) in view of Holzbach (US 6,795,241), further in view of Anderson (US 6,614,581).

Claim 1, MacAulay teaches a three-dimensional image pickup apparatus in Fig. 3, comprising:

- a plurality of light receiving elements for receiving and converting light into an electric signal (light detector 26 that comprises an array of individual detection pixels; col. 17, lines 46-50); and
- a plurality of light path selection elements for selecting different incoming angles of light to come to said light receiving elements at different times (spatial light modulator, e.g. digital micromirror device 34; col. 16, line 62-col. 17, line 9);

- said light receiving elements and said light path selection elements being arranged such that a plurality of pixels formed from said light receiving elements and said light path selection elements are disposed both in a row direction and a column direction (detection array and SLM array are aligned with each other; col. 17, lines 55-58, Fig. 4;
- intensities of the light received by said light receiving elements and the corresponding different incoming angles of light selected by said light path selection elements at different times being recorded in a coordinated relationship for the individual pixels, the recorded light intensities representing different image received by said light receiving elements at different incoming angles of light and at different times, wherein a three- dimensional image including the different images is provided when the recorded light intensities are reproduced (Controller compiles data obtained from the detector to reconstruct images. This would require the recording of the coordinated relationships of the angles of the SLMs and the intensity of light received by the light detector; col. 16, lines 10-12, col. 22, lines 40-57; col. 7, lines 60-col. 8, line 1; col. 23, lines 58-67; col. 24, lines 18-39);

MacAulay does not expressly teach that each light path selection element of said plurality of light path selection elements configured to select different incoming angles of light to come to said light receiving elements at different times to record different images at the different incoming angles of light; and that when the different images are reproduced by emitting light representing the different images at different outgoing angles of light and at different times, the different images are perceived by a viewer as a three-dimensional image and are perceived by the viewer as a different three-dimensional image when the viewer observes the different images from a different direction.

Holzbach teaches that different images (full parallax 3D images; col. 9, lines 29-32) are reproduced by emitting light (LEDs in the lenslet projector modules; col. 9, lines 5-7) representing the different images at different outgoing angles of light (lenslet contains elements to direct light in the appropriate direction to create the parallax image; see also DMD of col. 9, lines 7-8) and at different times (inherent in a moving picture display; col. 9, lines 20-23), the different images are perceived by a viewer as a three-dimensional image and are perceived by the viewer as a different three-dimensional image (full parallax 3D images) when the viewer observes the different images from a different direction (inherent in an autostereoscopic parallax display; i.e., the depth resolution changes as the viewing position changes. “An autostereoscopic display allows an observer to move around within a wide range of viewing positions, always presenting the correct information to the observer’s eyes.” See col. 5, lines 21-24.).

It would have been obvious to a person having ordinary skill in the art to have used the teaching of Holzbach with that of MacAulay in order to provide a system to present 3D information to an individual or group of observers without requiring each observer to wear special goggles or glasses. (See col. 2 , lines 40-49 of Holzbach.)

MacAulay in view of Holzbach does not expressly teach that each light path selection element of said plurality of light path selection elements configured to select different incoming angles of light to come to said light receiving elements at different times to record different images at the different incoming angles of light.

Anderson teaches a plurality of light path selection elements (an optical micromirror system 200 with a plurality of micromirrors 216) configured to select different incoming angles of light to be directed to a particular output depending on the voltage applied to the micromirror actuator (light is deflected according to the tilt position of a micromirror 216; col. 7, lines 33-57 and Figs. 2-3).

It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the micromirror system of Anderson with the pickup apparatus and digital micromirror device of MacAulay to select different incoming angles of light to come to said light receiving elements at different times to record different images at the differing incoming angles of light in to allow each micromirror to assume a wide variety of alignment positions as well as to overcome stiction in a MEMS device. (See col. 6, lines 3-5 and 17-19 of Anderson.)

Claim 2, MacAulay teaches that each of the pixels is formed from one of said light receiving elements and one of said light path selection elements which are paired with each other (col. 17, lines 55-58).

Claim 3, MacAulay teaches that the incoming angle of light selected by each of said light path selection elements varies as time passes (col. 22, lines 40-47).

Claim 4, MacAulay teaches that each of said light path selection elements is a reflecting element which drives a reflecting plate for reflecting light to select the incoming angle of light which comes to one of said light receiving elements so that the light of the incoming angle is light reflected by the reflecting plate (SLM may be a digital micromirror device that reflects light to the image plane 40; col. 16, lines 39-46).

Claim 5, MacAulay teaches that said reflecting element is a mirror plate, a Micro-Electro-Mechanical Systems element or a digital micromirror device (trade name) driven by a piezoelectric element (col. 16, lines 39-46).

Claim 8, MacAulay teaches that said light path selection elements are liquid crystal waveguides disposed in front of light receiving faces of said light receiving elements and selectively vary the refractive index of liquid crystal filled in said waveguides to select transmission paths of light (SLM can be an array of ferroelectric liquid crystal device; col. 15, line 27).

Claim 10, MacAulay teaches a three-dimensional image pickup apparatus, comprising:

- light intensity acquisition means for acquiring intensity information of received light (intensity of the light impinging on individual pixels in the detection array can be detected; col. 22, lines 44-45); and
- incoming angle acquisition means for acquiring corresponding incoming angle information of the received light at different incoming angles and at different times

(controller varies the orientation of the SLM and illuminates the object from a plurality of angles; col. 22, lines 40-45, col. 16, line 62-col. 17, line 9); the

- intensity information and the corresponding incoming angle information of the light being recorded in a coordinated relationship with each other the recorded intensity information representing different images received by said light intensity acquisition means at different incoming angles and at different times, wherein a three-dimensional image including the different images is provided when the recorded intensity information is reproduced (It is inherent that the intensity information and the incoming information be recorded in a coordinated relationship with each other in order to be reconstructed as an 3-D image of the sample; col. 22, lines 45-50; col. 7, lines 60-col. 8, line 1; col. 23, lines 58-67; col. 24, lines 18-39)

but does not expressly teach when the different images are reproduced by emitting light representing the different images at different outgoing angles of light and at different times, the different images are perceived by a viewer as a three-dimensional image and are perceived by the viewer as a different three-dimensional image when the viewer observes the different images from a different direction.

Holzbach teaches that different images (full parallax 3D images; col. 9, lines 29-32) are reproduced by emitting light (LEDs in the lenslet projector modules; col. 9, lines 5-7) representing the different images at different outgoing angles of light (lenslet contains elements to direct light in the appropriate direction to create the parallax image; see also DMD of col. 9, lines 7-8) and at different times (inherent in a moving picture display; col. 9, lines 20-23), the different images are perceived by a viewer as a three-dimensional image and are perceived by the viewer as a different three-dimensional image (full parallax 3D images) when the viewer observes the different images from a different direction (inherent in an autostereoscopic parallax display; i.e., the depth resolution changes as the viewing position changes. “An autostereoscopic display allows an observer to move around within a wide range of viewing positions, always presenting the correct information to the observer’s eyes.” See col. 5, lines 21-24.). See the rationale to combine in the analysis of claim 1.

MacAulay in view of Holzbach does not expressly teach that each light path selection element of said plurality of light path selection elements configured to select different incoming angles of light to come to said light receiving elements at different times to record different images at the different incoming angles of light.

Anderson teaches a plurality of light path selection elements (an optical micromirror system 200 with a plurality of micromirrors 216) configured to select different incoming angles of light to be directed to a particular output depending on the voltage applied to the micromirror actuator (light is deflected according to the tilt position of a micromirror 216; col. 7, lines 33-57 and Figs. 2-3).

It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the micromirror system of Anderson with the pickup apparatus and digital micromirror device of MacAulay to select different incoming angles of light to come to said light receiving elements at different times to record different images at the differing incoming angles of light in to allow each micromirror to assume a wide variety of alignment positions as well as to overcome stiction in a MEMS device. (See col. 6, lines 3-5 and 17-19 of Anderson.)

Claim 21, Holzbach teaches a three-dimensional image pickup and display apparatus in Fig. 14, comprising:

- a light reception section (detector element 172) including a plurality of light receiving elements for receiving and converting light into an electric signal and
- said light receiving elements and said first light path selection elements being arranged such that a plurality of pixels formed from said light receiving elements and said first light path selection elements are disposed both in a row direction and a column direction (col. 10, line 47),
- a light emission section (LED) including a plurality of light emitting elements for emitting light in accordance with an electric signal and a
- plurality of second light path selection elements (light modulator DMD) for selecting corresponding different outgoing angles of light to be emitted from said light emitting elements at different times (col. 10, lines 47-62),
- said light emitting elements and said second light path selection elements being arranged such that a plurality of pixels formed from said light emitting elements and said second light path selection elements are disposed both in a row direction and a column direction (col. 9, lines 9-15),
- said light emitting elements emitting light in accordance with a coordinated relationship between the corresponding different outgoing angles of light selected by

said second light path selection elements at different times and the intensities of light for the individual pixels based on the video signals to produce a three-dimensional image including the different images at the corresponding different outgoing angles of light and at different times (control both light intensity and light directions; col. 5, lines 13-17);

- to reproduce the different images at different outgoing angles of light (lenslet contains elements to direct light in the appropriate direction to create the parallax image; see also DMD of col. 9, lines 7-8) and at different times (inherent in a moving picture display; col. 9, lines 20-23), wherein the different images are perceived by a viewer as a three-dimensional image (full parallax 3D images) and are perceived by the viewer as a different three-dimensional image when the viewer observes the different images from a different direction (inherent in an autostereoscopic parallax display; i.e., the depth resolution changes as the viewing position changes. “An autostereoscopic display allows an observer to move around within a wide range of viewing positions, always presenting the correct information to the observer’s eyes.” See col. 5, lines 21-24.);

but does not expressly teach:

- a plurality of first light path selection elements for selecting different incoming angles of light to come to said light receiving elements at different times,
- intensities of the light received by said light receiving elements and the corresponding different incoming angles of light selected by said first light path selection elements at different times being coordinated with each other for the

individual pixels to form video signals that represent different images received by said light receiving elements at different incoming angles of light and at different times.

MacAulay teaches

- a plurality of first light path selection elements for selecting different incoming angles of light to come to said light receiving elements at different times (spatial light modulator, e.g. digital micromirror device 34, col. 16, line 62-col. 17, line 9), and
- intensities of the light received by said light receiving elements and the corresponding different incoming angles of light selected by said first light path selection elements at different times being coordinated with each other for the individual pixels to form video signals that represent different images received by said light receiving elements at different incoming angles of light and at different times (Controller compiles data obtained from the detector to reconstruct images. This would require the recording of the coordinated relationships of the angles of the SLMs and the intensity of light received by the light detector; col. 16, lines 10-12, col. 16, line 62-col. 17, line 9, col. 22, lines 40-57).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the light path selection elements of MacAulay with the apparatus of Holzbach to provide a significant advantage in controlling the angle of illumination, quantity of light, and the location of light reaching the detector. (See col. 2, lines 54-64 of MacAulay.)

Holzbach in view of MacAulay does not expressly teach that each first light path selection element of said plurality of first light path selection elements configured to select different incoming angles of light to come to said first light receiving elements at different times to record different images at the different incoming angles of light and that each second light path selection element of said plurality of second light path selection elements configured to select different outgoing angles of light to be emitted from said light emitting elements at different times.

Anderson teaches a plurality of light path selection elements (an optical micromirror system 200 with a plurality of micromirrors 216) configured to select different incoming angles of light to be directed to a particular output depending on the voltage applied to the micromirror actuator (light is deflected according to the tilt position of a micromirror 216; col. 7, lines 33-57 and Figs. 2-3).

It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the micromirror system of Anderson with the digital micromirror devices of Holzbach and MacAulay to select different incoming angles of light to come to said light receiving elements at different times to record different images at the differing incoming angles of light in to allow each micromirror to assume a wide variety of alignment positions as well as to overcome stiction in a MEMS device. (See col. 6, lines 3-5 and 17-19 of Anderson.)

Claim 37 is analyzed as an information recording method of the apparatus of claim 10.

4. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over MacAulay (US 6,483,641) in view of Holzbach (US 6,795,241) and Anderson (US 6,614,581), further in view of Moranski (US 6,094,289).

Claim 6, MacAulay in view of Holzbach and Anderson teaches a three-dimensional image pickup apparatus according to claim 1, but does not teach that said light path selection elements are driving members which carry and drive said light receiving elements to vary the directions in which light receiving faces of said light receiving elements are directed.

Moranski teaches driving members which carry and drive said light receiving elements to vary the directions in which light receiving faces of said light receiving elements are directed (photodetector 216 disposed on a free end of a cantilever beam; col. 13, lines 14-23).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the driving member of Moranski with the apparatus of MacAualay in view of Holzbach and Anderson in order to avoid a movable structure that is susceptible to mechanical fatigue and failure. The cantilever beam is a solid state device which has extremely high reliability. (See col. 2, lines 1-15 of Moranski.)

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over MacAulay (US 6,483,641) in view of Holzbach (US 6,795,241) and Anderson (US 6,614,581), further in view of Sun (US 6,415,068).

Claim 7, MacAulay in view of Holzbach and Anderson teaches a three-dimensional image pickup apparatus according to claim 1, but does not teach that said light path selection elements are lenses disposed in front of light receiving faces of said light receiving elements and drive said lenses to vary relative positions of said lenses to said light receiving elements.

Sun teaches that said light path selection elements are lenses disposed in front of light receiving faces of said light receiving elements and drive said lenses to vary relative positions of said lenses to said light receiving elements (col. 3, line 66-col. 4, line 7; col. 6, lines 10-16).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the microlenses of Sun with the apparatus of MacAulay in view of Holzbach and Anderson since the microlens switching assembly provides a fast switching of signals and a small required driving force.

6. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over MacAulay (US 6,483,641) in view of Holzbach (US 6,795,241) and Anderson (US 6,614,581), further in view of Hosoi (US 6,400,490).

Claim 9, MacAulay in view of Holzbach and Anderson teaches a three-dimensional image pickup apparatus according to claim 1, but does not teach that said light path selection elements are Mach-Zehnder elements disposed in front of light receiving faces of said light receiving elements and each selectively varies the refractive index of a phase control section provided in a light path to cause interference of light to select transmission paths of light.

Hosoi teaches that said light path selection elements are Mach-Zehnder elements (12).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the Mach-Zehnder waveguides of Hosoi with the apparatus of MacAulay in view of Holzbach and Anderson since the Mach-Zehnder optical modulator is stable with respect to disturbance and can obtain modulation characteristics featuring excellent signal-to-noise ratio. (See col. 1, lines 15-25 of Hosoi.)

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHIA-WEI A. CHEN whose telephone number is (571)270-1707. The examiner can normally be reached on Monday - Friday, 7:30 - 17:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lin Ye can be reached on (571) 272-7372. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Lin Ye/
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/C. A. C./
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